DOCUMENT RESUME

ED 060 088 TM 001 246

| | |
|---|---|
| TITLE | Dentist 072.108 -- Technical Report on Standardization of the General Aptitude Test Battery. Final Report. |
| INSTITUTION | Manpower Administration (DOL), Washington, D.C. U.S. Training and Employment Service. |
| REPORT NO | MSES-TR-S-49 |
| PUB DATE | Jun 54 |
| NOTE | 16p. |
| EDRS PRICE | MF-$0.65 HC-$3.29 |
| DESCRIPTORS | *Aptitude Tests; *Cutting Scores; *Dentists; Evaluation Criteria; Job Applicants; *Job Skills; Norms; Occupational Guidance; *Personnel Evaluation; Test Reliability; Test Validity |
| IDENTIFIERS | GATB; *General Aptitude Test Battery |

ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination ; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

FINAL REPORT





# TECHNICAL REPORT

# ON

# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

# FOR

DENTIST 072.108 072.108

S-49 S-49

(Supersedes B-239)

U. S. Employment Service in
Cooperation with
Minnesota State Employment Service



U. S. DEPARTMENT OF LABOR

Washington , D. C.
June 1954

# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR DENTIST 072.108

## Summary

The General Aptitude Test Battery was administered to two samples of students enrolled in the School of Dentistry at the University of Minnesota, Minneapolis, Minnesota.

The Validation Sample, or Sample #1, includes 96 students, three of whom are females. The B-1001 edition of the GATB was administered to this sample. Grades in course work obtained during the freshman year for each student were used as the criterion.

The General Aptitude Test Battery, B-1002A, was administered to the Cross Validation Sample, or Sample #2, which consists of 79 male and two female students. Grades in course work obtained during the freshman year for each student were also used as the criterion for this sample.

On the basis of the statistical results of the combined study, as well as the statistical results of each experimental sample analyzed separately, and the course analysis, the following aptitudes were found to be significant: (G) Intelligence, (S) Spatial Aptitude, (P) Form Perception and (F) Finger Dexterity.

## GATB Norms for Dentist 072.108

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Dentist 072.108.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-49

| B-1001 | | | B-1002 | | |
|---|---|---|---|---|---|
| Aptitude | Tests | Minimum Acceptable Aptitude Score | Aptitude | Tests | Minimum Acceptable Aptitude Score |
| G | CB-1-H<br>CB-1-I<br>CB-1-J | 120 | G | Part 3<br>Part 4<br>Part 6 | 115 |
| S | CB-1-F<br>CB-1-H | 115 | S | Part 3 | 110 |
| P | CB-1-A<br>CB-1-L | 100 | P | Part 5<br>Part 7 | 100 |
| F | CB-1-O<br>CB-1-P | 90 | F | Part 11<br>Part 12 | 85 |

Effectiveness of Norms

The data in Table V-C indicate that 21 of the 42 poor students, or 50% of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. Moreover, 113 of the 134 students who made qualifying test scores, or 84%, were good students.

TECHNICAL REPORT

## I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Dentist 072.108.

## II. Sample

This study is based on two samples of entering freshman students enrolled in the four year course in the School of Dentistry at the University of Minnesota, Minneapolis, Minnesota.

Students in Sample #1, the Validation Sample, were tested with the GATB, B-1001, during their first week as freshmen in October 1950. Ninety-seven of the 101 freshman students were tested. Four students were absent on the day of testing and complete criterion data were not available for one of the students. The final sample includes 96 students. All but three of the students are males.

The Cross Validation Sample, or Sample #2, consisting of 81 of the 95 entering freshman dental students, was tested with the B-1002A edition of the GATB. These students were tested at the beginning of their second quarter in January 1953. Eight students had dropped from the class prior to the test administration on the basis of low scholarship. The remaining six students in the class were omitted from the sample because of absence on the dates the tests were administered or because of insufficient criterion data.

Requirements for admission to the School of Dentistry at the University of Minnesota are two years (90 quarter hours or 60 semester hours) of pre-dental course work in an accredited college of liberal arts. A scholastic average of at least "C" must be maintained in the pre-dental sequence.

Students included in the Validation Sample were not selected for entry into dental school on the basis of test performance. However, when students in the Cross Validation Sample entered dental school, selection of applicants was made by a committee of dental school faculty members mainly on the basis of pre-dental course work and test results (other than GATB). The tests used are those included in the Council of Dental Education of the American Dental Association Dental Aptitude Test Battery. This battery includes various measures of scholastic aptitude, spatial ability, verbal ability and finger-knife dexterity. Approximately one-third of the applicants were selected for this class of dental students.

Tables II-A and II-B show the means, standard deviations, ranges, Pearson product-moment correlations with the criteria, and the standard errors of correlation for age and education for the Validation Sample and Cross Validation Sample, respectively. Table II-C shows the means, standard deviations and ranges for age and education for the combined sample.

TABLE II-A

Means (M), Standard Deviations ($\sigma$), Ranges, Pearson Product-Moment Correlations with the Criterion of Lecture Honor Point Ratios ($r_1$), and Laboratory Course Grades ($r_2$) and the Standard Errors of Correlation ($\sigma_{r_1}$ and $\sigma_{r_2}$) for Age and Education

Dentist 072.108

Validation Sample
N = 96

| | M | $\sigma$ | Range | $r_1$ | $\sigma_{r_1}$ | $r_2$* | $\sigma_{r_2}$* |
|---|---|---|---|---|---|---|---|
| Age (years) | 22.9 | 3.3 | 19-38 | -.047 | .102 | .074 | .105 |
| Education (years) | 14.9 | 1.0 | 14-18 | .120 | .101 | .023 | .106 |

*N=89, Laboratory course grades were not available for seven students.

TABLE II-B

Means (M), Standard Deviations ($\sigma$), Ranges, Pearson Product-Moment Correlations with the Criterion of Lecture Honor Point Ratios ($r_1$), and Laboratory Course Grades ($r_2$) and the Standard Errors of Correlation ($\sigma_{r_1}$ and $\sigma_{r_2}$) for Age and Education

Dentist 072.108

Cross Validation Sample
N = 81

| | M | $\sigma$ | Range | $r_1$ | $\sigma_{r_1}$ | $r_2$ | $\sigma_{r_2}$ |
|---|---|---|---|---|---|---|---|
| Age (years) | 22.6 | 2.7 | 20-34 | -.083 | .110 | .160 | .108 |
| Education (years) | 14.5 | 0.8 | 13-17 | .045 | .111 | .185 | .107 |

TABLE II-C

Means (M), Standard Deviations ($\sigma$) and Ranges for Age and Education

Dentist 072.108

Combined Sample
N = 177

| | M | $\sigma$ | Range |
|---|---|---|---|
| Age (years) | 22.8 | 3.0 | 19-38 |
| Education (years) | 14.7 | 0.9 | 13-18 |

The data in Tables II-A and II-B show that the two samples are quite similar with respect to age and education. There are no significant relationships between age or education and the criterion of either the Validation or Cross Validation Sample. Both samples are actually more homogeneous than indicated by the age ranges, which reflect a few extreme cases. Although only two years of pre-dental course work are required, a number of the students have more than the minimum amount of education necessary for entrance into the School of Dentistry at the University of Minnesota.

III. Job Description

Job Title: Dentist 072.108

Job Summary:

Engages in the practice of dentistry, or any phase of dentistry, such as extracting, filling, cleaning, or replacing teeth; performs corrective work, such as straightening teeth; treats diseased tissue of the gums; performs surgical operations on jaw or mouth; and makes and fits false teeth. May specialize in one particular phase of dentistry, in the caring for teeth of children, or in X-ray analysis.

Course Description:

Eight courses constitute the freshman dental curriculum and represent the basis for the criteria. Two courses, Metallography and Development of Occlusions, were not in the curriculum at the time Sample #1 was tested. These courses were included in the criterion for Sample #2 because they contain material that had been previously included in other courses and because they are to become a permanent part of the dental school curriculum. Two courses, Dental Anatomy and Prosthetics Laboratory, were given each quarter during the freshman year. One course, Physiological Chemistry, was given two of the three quarters in the freshman year. The courses, course descriptions, and credits are as follows:

> Prosthetics Laboratory. A course of lectures, demonstrations, examinations, and laboratory instruction covering the various phases of complete and partial denture prosthesis, materials used, their properties and manipulations; fundamental principles of denture construction including retention, occlusions, and esthetics, instruments and terminology used in dental prosthesis. 11 credits.
>
> Dental Anatomy. A course of lectures, quizzes, examinations, and laboratory instruction. Lectures: dental nomenclature with special attention to definition, spelling, derivation, combining, and application of terms used in the various divisions of dentistry; a detailed study of all deciduous and permanent teeth including calcification, eruption, decalcification and shedding, tooth form, function, stresses, all phases of occlusion; surrounding and investing tissues; pulp cavities and anomalies. Laboratory instruction projects included are outline drawings, plastine modeling, wax carvings individually and as an anatomical unit, sectioning of teeth. 8 credits.

Systematic Anatomy. A comprehensive treatment of the various organ systems of the human body. Lectures, recitations and laboratory work. 6 credits.

Dental Bacteriology. Morphology; methods of staining; culture media; methods of identification; principles of sterilization and disinfection; antibiotics; bacteria and disease; pathogenic bacteria; fundamentals of immunology; the oral flora; bacteriology of oral infections, dental caries, alveolar abscess, and periodontal infection; the relationship of oral infections to other focal and general infections. 6 credits.

Anatomy of the Head and Neck. Detailed dissection of the human head and neck with correlative treatment of the upper extremity. 6 credits.

Physiological Chemistry. (No course description available.) 11 credits.

Metallography. Lectures, recitations, and demonstrations, taking up the most important metals with special reference to those used in dentistry and the study of dental alloys from the standpoint of metallography. 2 credits.

Development of Occlusion. An introduction to the post-natal growth of the dento-facial complex. 2 credits.

## IV. Experimental Battery

All of the tests of the GATB, B-1001, were administered to the Validation Sample and all parts of the GATB, B-1002A, were administered to the Cross Validation Sample.

## V. Criterion

There were two criteria available for each sample; one criterion consisted of lecture course grades and the other consisted of laboratory course grades.

### Lecture Course Grade Criterion

The faculty of the School of Dentistry believed that all but two of the freshman courses could be considered to be lecture or theory courses. The criterion for the lecture work was derived by subtracting the honor points and credits earned in Prosthetic Laboratory and Dental (Oral) Anatomy, both of which are primarily laboratory work, from the honor points and credits earned in the remaining courses taken during the freshman year. Because of the slight revision in the course content between the time of testing of Sample #1 and Sample #2, there is a difference in the total credits for the freshman year of each of these samples. For Sample #1 there is a total of 47 credits, and for Sample #2 there is a total of 52 credits for the freshman year. For Sample #1, the theory courses include 29 of the total 47 credits. For Sample #2 the theory courses include 33 of the total of 52 credits.

Table III-A shows the means, standard deviations and ranges of the lecture honor point ratios for the Validation Sample and the Cross Validation Sample.

TABLE III-A

Means (M), Standard Deviations (σ), and Ranges (R)
of Lecture Honor Point Ratios

Dentist 072.108

Validation and Cross Validation Samples

| Sample | N | M | σ | R |
|---|---|---|---|---|
| Validation | 96 | 3.3 | 0.8 | 1.00-5.00 |
| Cross Validation | 81 | 3.5 | 0.6 | 2.42-4.94 |

The data in Table III-A show that the range of lecture course grades for the Cross Validation Sample is somewhat restricted in comparison with the range for the Validation Sample. This may be partially due to the fact that students in the Cross Validation Sample had been screened on the basis of test performance (other than GATB) when they applied for entrance into the School of Dentistry, whereas this is not true for students in the Validation Sample. An additional factor which contributed to restricting the range of scholastic ability of the Cross Validation Sample is that eight students had dropped out of the class because of low scholarship prior to the administration of the GATB.

Laboratory Course Grade Criterion

The criterion for the laboratory work is based on the average weighted numerical grade received for laboratory projects in three quarters of laboratory work in Prosthetic Laboratory and Dental Anatomy. The average grade is a composite of grades received in projects, such as plastine modeling, wax carving, and denture construction. The grade received for each project is based on the instructor's estimate of the quality of the work sample turned in by each student. Grades on these required projects as well as written laboratory examinations are combined by a system of weighting to give a final course grade. The weights assigned the work projects are based on such factors as complexity and the length of the project. These weights were applied to the grades of each student to obtain an average grade in laboratory projects which would reflect the importance of the project as determined by the instructor. The same system of grading was used on all projects so the distribution of grades for each project is similar. The grades in the written examinations and quizzes given in conjunction with the laboratory work are not included in the criterion.

Table III-B shows the means, standard deviations and ranges of the numerical grade averages in laboratory course work for the Validation Sample and the Cross Validation Sample.

TABLE III-B

Means (M), Standard Deviations (σ), and Ranges (R) of Laboratory Project Grades

Dentist 072.108

Validation and Cross Validation Samples

| Sample | N | M | σ | R |
|---|---|---|---|---|
| Validation | 89* | 86.7 | 2.1 | 79.6-93.2 |
| Cross Validation | 81 | 87.4 | 1.6 | 83.9-91.5 |

*Laboratory course grades were available for only 89 of the 96 students in Sample #1.

The data in Table III-B show that the range of laboratory course grades is also more restricted for the Cross Validation Sample than for the Validation Sample. It is likely that the laboratory course grades were influenced by the same factors which tended to restrict the range of lecture course grades of the Cross Validation Sample.

Composite Criterion

Both lecture course and laboratory course grades served as a basis for establishing a dichotomized criterion to be used in the computation of tetrachoric correlation coefficients and application of the Chi Square test to evaluate test norms. The dichotomized criterion was established by setting a critical score on lecture grades as well as a critical score on laboratory course grades; a student had to equal or exceed each critical score in order to be placed in the high criterion group; all students below either critical score were placed in the low criterion group. This criterion was constructed after a discussion with the faculty regarding the relative importance of laboratory and clinical work and of lecture course work in the freshman curriculum and in the entire four year curriculum. Laboratory work consists of only 1/3 of the total credit hours in the freshman year, but takes on progressively increasing emphasis in the remaining three years. Although an exact division of the entire four year curriculum in terms of the portion of laboratory work and of lecture work could not be made by members of the faculty, they believed the two to be of equal importance.

## VI. Statistical and Qualitative Analysis

Both samples of dental students have undergone the same type of training in preparation for the same profession. Examination of available data has shown that the two samples are sufficiently similar with respect to age, education, school grades and aptitude level to warrant combining the data whenever statistically feasible. Therefore, data for the samples have been analyzed separately and in combination on the basis of both statistical and qualitative considerations. Means, standard deviations and correlations with the criterion were calculated for the [illegible]de scores for each sample separately, and for the combined sample whenever statistically feasible. Since Sample #1 was tested with the B-1001

edition of the GATB and Sample #2 was tested with the B-1002A edition of the GATB, it was necessary to convert the B-1001 aptitude score means and sigmas of Sample #1 to equivalent B-1002 means and sigmas before combining the data of these two samples. The conversions were based on standard score equations for B-1001 and B-1002 aptitude scores. Appropriate formulae were used to combine the data to obtain means and sigmas of the B-1002 aptitude scores for the combined sample of 177 dental students.

The B-1001 means and standard deviations, equivalent B-1002 means and standard deviations, Pearson product-moment correlations with the criteria and standard errors of correlation for the aptitudes of the GATB are shown in Table IV-A for Sample #1. The means, standard deviations, Pearson product-moment correlations with the criteria and standard errors of correlation for the aptitudes of the GATB, B-1002, are shown in Table IV-B for Sample #2. Table IV-C shows the means and standard deviations for the aptitudes of the GATB, B-1002, for the combined sample.

The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE IV-A

B-1001 Means (M), Standard Deviations ($\sigma$), Equivalent B-1002 Means and Standard Deviations, Pearson Product-Moment Correlations with the Criteria of Lecture Honor Point Ratios ($r_1$) and Laboratory Course Grades ($r_2$), and Standard Errors of Correlation ($\sigma_{r_1}$ and $\sigma_{r_2}$) for the Aptitudes of the GATB

Dentist 072.108

Validation Sample
N = 96

| | B-1001 | | Equivalent B-1002 | | | | | |
|---|---|---|---|---|---|---|---|---|
| Aptitudes | M | $\sigma$ | M | $\sigma$ | $r_1$ | $\sigma_{r_1}$ | $r_2$ # | $\sigma_{r_2}$ # |
| G-Intelligence | 138.5 | 10.4 | 132 | 9 | .243* | .096 | .132 | .104 |
| V-Verbal Aptitude | 123.0 | 13.0 | 121 | 13 | .152 | .100 | .033 | .106 |
| N-Numerical Aptitude | 131.2 | 10.5 | 124 | 10 | .205* | .098 | -.061 | .106 |
| S-Spatial Aptitude | 136.7 | 14.5 | 132 | 14 | .289** | .094 | .339** | .094 |
| P-Form Perception | 122.7 | 13.7 | 120 | 13 | -.021 | .102 | .327** | .095 |
| Q-Clerical Perception | 115.1 | 12.1 | 114 | 11 | -.037 | .102 | .049 | .106 |
| A-Aiming ## | 107.7 | 12.2 | 109 | 11 | -.222* | .097 | .107 | .105 |
| T-Motor Speed ## | 107.6 | 15.5 | 110 | 15 | -.232* | .097 | .060 | .106 |
| F-Finger Dexterity | 110.5 | 17.3 | 107 | 15 | -.085 | .101 | .235* | .100 |
| M-Manual Dexterity | 114.2 | 15.6 | 111 | 15 | -.179 | .099 | .136 | .104 |

**Significant at the .01 level.
*Significant at the .05 level.

#N = 89, Laboratory Course Grades were not available for 7 people.

##Converts to equivalent B-1002 score on Aptitude K, Motor Coordination.

TABLE IV-B

Means (M), Standard Deviations ($\sigma$), Pearson Product-Moment Correlations with the Criteria of Lecture Honor Point Ratios ($r_1$) and Laboratory Course Grades ($r_2$), and Standard Errors of Correlation ($\sigma_{r_1}$ and $\sigma_{r_2}$) for the Aptitudes of the GATB, B-1002

Dentist 072.108

Cross Validation Sample
N = 81

| Aptitudes | M | $\sigma$ | $r_1$ | $\sigma_{r_1}$ | $r_2$ | $\sigma_{r_2}$ |
|---|---|---|---|---|---|---|
| G-Intelligence | 129.9 | 13.4 | -.001 | .111 | .054 | .111 |
| V-Verbal Aptitude | 120.2 | 13.3 | -.080 | .110 | -.135 | .109 |
| N-Numerical Aptitude | 121.4 | 13.2 | -.037 | .111 | -.138 | .109 |
| S-Spatial Aptitude | 135.1 | 19.2 | .055 | .111 | .235* | .105 |
| P-Form Perception | 124.0 | 14.8 | .034 | .111 | .157 | .108 |
| Q-Clerical Perception | 122.3 | 13.1 | .032 | .111 | .131 | .109 |
| K-Motor Coordination | 122.0 | 15.3 | .149 | .109 | .079 | .110 |
| F-Finger Dexterity | 112.4 | 15.4 | .073 | .111 | .304** | .101 |
| M-Manual Dexterity | 112.8 | 15.2 | .016 | .111 | .188 | .107 |

**Significant at the .01 level.
*Significant at the .05 level.

TABLE IV-C

Means (M) and Standard Deviations ($\sigma$) for the Aptitudes of the GATB, B-1002

Dentist 072.108

Combined Sample
N = 177

| Aptitudes | M | $\sigma$ |
|---|---|---|
| G-Intelligence | 131 | 11 |
| V-Verbal Aptitude | 121 | 13 |
| N-Numerical Aptitude | 123 | 12 |
| S-Spatial Aptitude | 133 | 17 |
| P-Form Perception | 122 | 14 |
| Q-Clerical Perception | 118 | 13 |
| K-Motor Coordination # | 115 | 16 |
| F-Finger Dexterity | 109 | 16 |
| M-Manual Dexterity | 112 | 16 |

#Based on combination of converted Aptitude T data for the Validation Sample and Aptitude K data for the Cross Validation Sample.

The statistical results were interpreted in the light of the course and job analysis data. The course and job analysis data indicated that the following aptitudes measured by the GATB appeared to be important for the field of dentistry:

Aptitude G - Intelligence - basic in the job and course analysis to learn and understand the underlying principles of dentistry.

Aptitude V - Verbal Aptitude - necessary for reading comprehension, understanding of notes taken from lecture material, and facility of expression which are all needed for the learning of a technical profession.

Aptitude S - Spatial Aptitude - needed to comprehend relationships of figures and models in the study of tooth forms, functions, stresses and all phases of occlusions.

Aptitude P - Form Perception - required to perceive pertinent details of tooth forms.

Aptitude F - Finger Dexterity - needed to manipulate small objects with the fingers in dental construction, instrument and material handling and in laboratory projects.

The aptitude profiles of the Validation Sample and the Cross Validation Sample are quite similar with respect to the aptitudes indicated as significant in the course analysis. The mean scores of the Validation Sample are slightly higher than those of the Cross Validation Sample, except for Aptitudes Q, K, and F.

In Table IV-A, which presents data for the Validation Sample, Aptitude S shows significant correlation at the .01 level and Aptitudes G and N show significant correlation at the .05 level with the lecture course grade criterion. Aptitudes A and T show negative correlations with the lecture grade criterion that are significant at the .05 level. Aptitudes S and P show correlation significant at the .01 level and Aptitude F shows correlation significant at the .05 level with the laboratory course grade criterion.

The data for the Cross Validation Sample, which appear in Table IV-B, show that there are no significant correlations with the lecture course grade criterion. Aptitude F shows significant correlation at the .01 level with the criterion of laboratory course grades and Aptitude S at the .05 level with the laboratory course grade criterion. The fact that students in this sample had been screened on the basis of test performance, and that the range of ability was more restricted than in the Validation Sample, as evidenced by the data in Tables III-A and III-B, may partially account for the fact that fewer significant validity coefficients were obtained for this sample than for the Validation Sample.

The data in Table IV-C show that Aptitudes S, G, and P, in that order respectively, have the highest mean scores for the combined sample. Aptitudes G and S also show the highest mean scores for each of the individual samples.

On the basis of all the foregoing considerations, including both quantitative and qualitative factors, Aptitudes G, S, P, and F were chosen for inclusion in the test norms. Each of these aptitudes was found to be significant on the basis of course and job analysis data. In addition, Aptitude G was included in the test norms on the basis of showing the second highest mean score and the lowest

standard deviation for the combined sample, and a correlation significant at the .05 level with the criterion of lecture course grades for the Validation Sample. The inclusion of Aptitude S in the test norms is warranted statistically on the basis of showing the highest mean score for the combined sample, correlations significant at the .01 level with the criteria of lecture course grades and laboratory course grades for the Validation Sample, and correlation significant at the .05 level with the criterion of laboratory course grades for the Cross Validation Sample. Statistical data which support the inclusion of Aptitude P in the test norms are a relatively high mean score, low sigma, and a correlation significant at the .05 level with the criterion of laboratory course grades for the Validation Sample. Significant correlation at the .05 level with the criterion of laboratory course grades for the Validation Sample, and significant correlation at the .01 level with the criterion of laboratory course grades for the Cross Validation Sample, warrant the inclusion of Aptitude F in the test norms.

Aptitudes V and N were also given consideration for inclusion in the test norms on the basis of the statistical and qualitative data. However, the evidence to warrant the inclusion of Aptitudes G, S, P, and F was greater than the evidence supporting Aptitudes V and N. Aptitude V did not show significant correlation with either of the criteria for either sample. Although Aptitude N showed a significant correlation at the .05 level with lecture course grades for the Validation Sample, the correlation coefficient was of relatively small magnitude (.205). In addition Aptitudes V and N did not appear to be as important as Aptitudes G, S, P and F on the basis of course and job analysis data. Therefore, Aptitudes V and N were omitted from the test norms.

In order to compute the tetrachoric correlation coefficient and its standard error, and the Chi Square value for the Validation and Cross Validation Samples, a composite dichotomized criterion was established on the basis of both lecture and laboratory course grades, as already described under "Criterion." For the Validation Sample, the critical scores on lecture theory work and laboratory course work were set at 2.5 and 85.0, respectively, in order to obtain a proportion of students in the low group commensurate with the rate of failure in the freshman class, which is usually about 20 percent. The highest rate of failures in the School of Dentistry occurs in the freshman year. Seven of the students for whom there were no laboratory grades are included in the low criterion group, since they had lecture grades of less than 2.5. Those students who equalled or exceeded 2.5 on lecture grades and 85.0 on laboratory grades were placed in the high criterion group and designated as "good students." Those students who did not meet either critical score were placed in the low criterion group and designated as "poor students."

The criterion for the Cross Validation Sample was dichotomized using the same method as for the Validation Sample. However, in order to include approximately the same proportion of students in the low criterion group as there are failures in the freshman year, the critical scores for the lecture theory work and the laboratory course work were set at 2.8 and 85.3, respectively.

The cutting scores for Aptitudes G, S, P, and F were set at one and one-half standard deviation units below the mean scores of the combined sample and rounded to the nearest five-point score levels. The cutting scores were set somewhat lower than usual so that the test norms would eliminate approximately the same

percentage of the sample that was in the low criterion group. Setting cutting scores at these levels yielded the best selective efficiency for the norms and resulted in B-1002 cutting scores of 115, 110, 100 and 85 for Aptitudes G, S, P and F, respectively. The B-1002 norms were converted to equivalent (on the basis of standard score equations) B-1001 norms consisting of G-120, S-115, P-100 and F-90.

The B-1001 norms were used to compute the tetrachoric correlation and apply the Chi Square test for the Validation Sample; the equivalent B-1002 norms were used when these computations were made for the Cross Validation Sample. The tetrachoric correlation and Chi Square test for the combined sample are based on a table which is a composite of the tables obtained for each sample and for its respective norms.

Tables V-A and V-B show the discriminative value of the B-1001 norms and B-1002 norms for the Validation and Cross Validation Samples, respectively. Table V-C shows the discriminative value of the norms for the combined sample.

TABLE V-A

Relationship Between B-1001 Test Norms Consisting of Aptitudes G, S, P, and F with Critical Scores of 120, 115, 100, and 90, Respectively and the Criterion for the Validation Sample

Dentist 072.108

N = 96

| | Non-Qualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Students | 11 | 61 | 72 |
| Poor Students | 13 | 11 | 24 |
| Total | 24 | 72 | 96 |

$r_{tet} = .64$ $\quad X^2 = 12.519$

$\sigma_{r_{tet}} = .19$ $\quad P/2 < .0005$

The data in the above table indicate a high and significant relationship between the B-1001 test norms and the criterion for the Validation Sample.

TABLE V-B

Relationship Between B-1002 Test Norms Consisting of Aptitudes G, S, P, and F with Critical Scores of 115, 110, 100, and 85, Respectively and the Criterion for the Cross Validation Sample

Dentist .072.108

N = 81

| | Non-Qualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Students | 11 | 52 | 63 |
| Poor Students | 8 | 10 | 18 |
| Total | 19 | 62 | 81 |

$r_{tet}$ = .48 $X^2$ = 4.274

$\sigma_{r_{tet}}$ = .21 P/2 $<$ .025

The data in the above table indicate a significant relationship between the B-1002 test norms and the criterion for the Cross Validation Sample.

TABLE V-C

Relationship Between Test Norms and the Criterion for the Combined Sample

B-1001 Norms: G-120, S-115, P-100, F-90
B-1002 Norms: G-115, S-110, P-100, F-85

Dentist .072.108
N = 177

| | Non-Qualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Students | 22 | 113 | 135 |
| Poor Students | 21 | 21 | 42 |
| Total | 43 | 134 | 177 |

$r_{tet}$ = .57 $X^2$ = 17.995

$\sigma_{r_{tet}}$ = .14 P/2 $<$ .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the combined sample. The Chi Square test indicates that there are fewer than five chances in ten thousand that the ined positive relationship between the test norms and the criterion rred by chance.

## VII. Conclusions

On the basis of mean scores, standard deviations, correlation coefficients, job and course analysis data and their combined predictive efficiency, it is recommended that Aptitudes G, S, P, and F with minimum scores of 115, 110, 100, and 85, respectively, be used as B-1002 norms for Dentist .072.108 Equivalent B-1001 norms consist of G-120, S-115, P-100 and F-90.